Phenology of Damage by Citrus Peelminer Population in an Orange Grove

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The phenology of damage and estimation of losses from citrus peelminer (CPM) (*Marmara gulosa* Guillen and Davis; Lepidoptera: Gracillariidae) has been investigated in a block of Fukomoto navels in Tulare County since late 2000. The northwest corner of the block (17 rows by eight trees) was sampled at approximately two-week intervals from May 22 through October 23. During the first half of the summer, May 22 through July 29, five stems on 20 trees selected at random were examined for evidence of CPM. The number of active (mines with live larvae) and inactive (mines with no or dead larvae) mines on each stem was recorded. For the last half of the summer, August 13 through October 23, 10 fruit on each of 40 trees selected at random were examined. Each fruit was given a damage rating and the number of mines on each fruit was counted. The ratings were: 0 = no mining; 1 = 1 to 25 percent of surface area mined; 2 = 26 to 50 percent of surface area mined; 3 = 51 to 75 percent of surface area mined; and 4 = > 76 percent of surface area mined.

The entire block (32 rows by 24 trees) was mapped on November 6, 7, and 14, prior to fruit harvest. Twelve fruit on each tree (one fruit at the lower, middle, and upper portion of the tree on each compass point) were assessed for damage using the rating scheme given above. Each tree was then assigned to a damage category. Damage categories were: none equals CPM infestation nearly undetectable with most of the fruit marketable; few equals CPM infestation detectable with about 67 percent of the fruit marketable; medium equals CPM infestation easily detectable with about 50 percent of the fruit marketable; and lots equals CPM infestation heavy with less than 33 percent of the fruit marketable. Chi-squared analysis was applied to a portion of the data (odd-numbered rows from nine through 31) to determine if CPM was found evenly throughout a tree.

The damage ratings on the fruit increased gradually from the end of August through October (Figure 1). In samplings earlier than this, only one active mine was found on a stem near a fruit (July 17). In terms of the distribution of fruit in each damage-rating category, a gradual increase in damaged fruit was seen from the middle of August through the end of October (Figure 2). (Note that for the August 13 and 27 sampling dates, only 200 fruit were examined due to time constraints). Fruit with the highest damage rating (four) were not found until the final sampling date, and only two of the 400 fruit were this damaged.

The final mapping for 2002 had far fewer trees in the extreme damage categories (medium and lots) than in previous years (Table 1). The trees with the heaviest damage were found in the northwest corner and along the west side. This is not surprising considering that the major source of infestation, a cotton field, was located immediately northwest of the block. The decrease in damage in this block as compared to previous years may have been due to a combination of placement of experimental pheromone traps within the block at a time of maximum moth flight, and the rapid picking, shredding, and disking of the cotton field. In other navel orange groves that were routinely sampled in other studies, more extensive damage to the fruit occurred than seen in this block.

The chi-squared analysis of the damage ratings in the final mapping revealed that more damaged fruit were found on the east side of the tree than would be expected if there was a proportional distribution of mined fruit ($X^2 = 40.8$, df = 3; $P < 0.01$). This side of the tree would be the “protected” side of the tree from the prevailing winds (usually out of the northwest). In terms of the height of the fruit on the tree, a greater proportion of damaged fruit was found on

the lower and upper portions of the tree (X^2 = 23, df = 23; P < 0.01). These positions on the tree may be somewhat more protected than the middle part of the tree. As the fruit enlarges, branches on the bottom of the tree tend to touch the ground, providing a protected place for the CPM. Fruit on the upper parts of the tree tend to be either in the interior of the tree, or the branches bend down with the weight of the fruit, creating protected areas for the CPM. Female CPM seems to prefer to oviposit on fruit or stems that either have many leaves around them or are shaded from the sun.

Table 1. The number and percent of trees in each of the damage categories in a Fukomoto block in Tulare County from 2000 through 2002.

Year	None	Few	Medium	Lots
2000	303 (39.5%)	191 (24.9%)	249 (32.5%)	24 (3.1%)
2001	102 (13.3%)	376 (49%)	200 (26.1%)	89 (11.6%)
2002	295 (38.5%)	346 (45.1%)	97 (12.6%)	29 (3.8%)

Figure 1. The mean damage rating on fruit from the northwest corner of a block of Fukomoto navels in Tulare County in 2002.

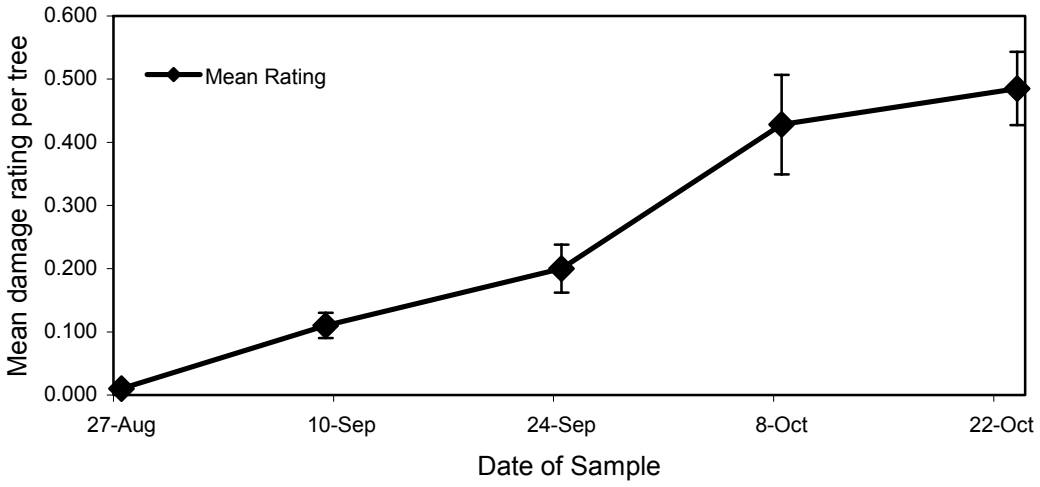
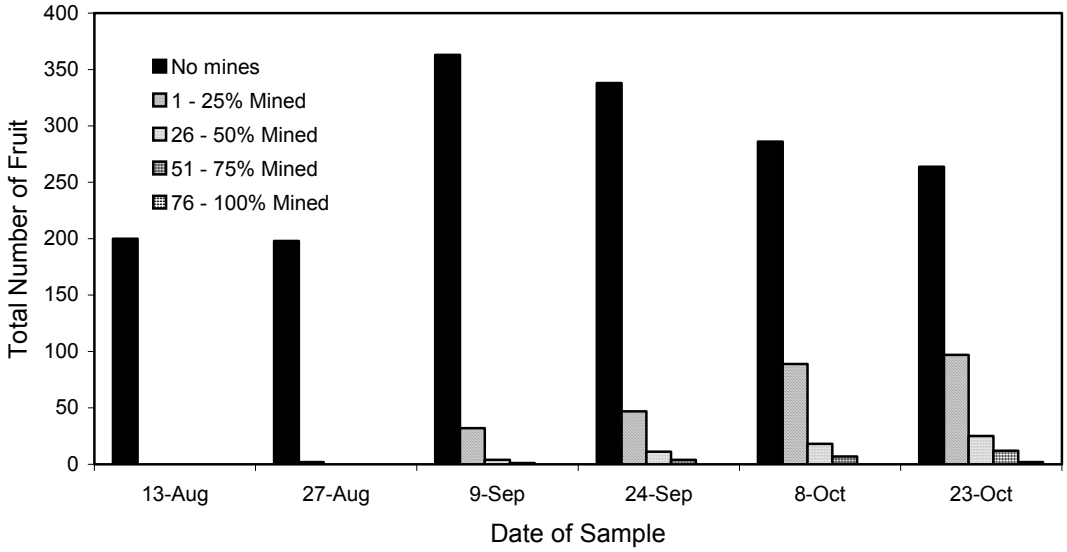


Figure 2. The total number of fruit in each damage-rating category on each sample date in the northwest corner of a block of Fukomoto navels in Tulare County in 2002.



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